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STUDIES OF THE INNER SHELF AND COASTAL SEDIMENTATION ENVIRONMENT OF
THE BEAUFORT SEA FROM ERTS-1_/_

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Type I Progress Report
ERTS-1

- (A) Studies of the Inner Shelf and Coastal Sedimentation Environment of the Beaufort Sea from ERTS-1

ERTS-A Proposal No.: SR 206 Subdisciplines: 3I, 4C, 5B, 5E
5F, 5G, 5H, 7D

- (B) GSFC ID No. of P.I.: IN 394

- (C) Statement and explanation of any problems that are impeding the progress of the investigation.

Because of low sun angles no imagery was obtained in the study area during the reporting period.

After submission of our type II progress report we were informed that 13 copies of every illustration, and two negatives for each are required. This requirement seems unreasonable, and puts an undue strain on the investigator, as we are not in the copying business. The use of illustrations will of necessity be limited in future reports.

- (D) Discussion of the accomplishments during the reporting period and those planned for the next reporting period.

Progress in several different endeavors can be reported on:

(1) A paper entitled "New insights into the influence of ice on the coastal marine environment of the Beaufort Sea, Alaska" was prepared for the ERTS-1 Symposium, held in March 1973. This paper was presented there by Peter Barnes.

(2) Data and observations from the NASA sponsored river breakup

studies in the spring of 1972, and from the open season studies of the R/V LOON, related to "strudel scour" of the sea floor surrounding Arctic deltas, have been compiled and analyzed. This scour phenomenon, studied with side scan sonar, fathometer, high resolution seismic gear, sediment sampling, and by direct diving observations, is found to occur in all areas affected by river water overflow on the fast ice. A manuscript has been prepared for publication.

(3) Analysis of high resolution seismic records obtained in the test site area during 1972 is in progress. An attempt is being made to delineate thickness and distribution of Holocene marine sediments in the area, and to compare this with data on sediment sources, dispersal, and processes, in conjunction with ERTS-1 imagery.

(4) Laboratory analysis of sediments is near completion, and the results will now be analyzed by computer and compiled.

(5) Analysis of suspended particulate transport, using Secchi Disk, Transmissivity values, and suspended matter concentrations, has been completed for 1971 and 1972 open seasons. An interpretation of this data is being aided by ERTS-1 imagery and is being prepared in manuscript form.

(E) Discussion of significant scientific results and their relationship to practical applications or operational problems including estimates of the cost benefits of any significant results.

Northward flowing rivers of Alaska inundate extensive areas of sea ice during spring breakup. This process has been studied under

the ERTS-1 program. Satellite data not available for last spring should be obtained in spring of 1973. Drainage of large volumes of fresh water through the ice at holes and cracks (strudel) causes scour depressions, over 4 m deep, and up to 20 m across in the sea floor below. These modern strudel scours and their filled counterparts were studied by side scan sonar, fathometer, high resolution seismic gear, diving observations, and by sediment sampling.

Strudel scours occur within 30 km of river mouths, generally in areas where ERTS imagery shows less potential for drifting ice to scour the bottom than elsewhere. The shapes and distribution patterns of strudel scours correspond with those of strudel seen in the ice canopy. Densities of scours are highest in the inner areas of overflow, with values of up to 25/km of ship's track. But strudel scours also occur outside of overflow areas mapped during the last several years. These must be relatively old. Presumably they are preserved for several tens of years, before being filled in completely.

One strudel scour investigated by diving is surrounded by a rim, has vertical walls exposing a tundra horizon, and terminates at a gravel layer 4 m below the lagoon floor. Another one terminates at a semi-consolidated layer of silty clay. The gravel and silty clay are pre-Holocene deposits. Seismic records also show that all of the Holocene marine sediments around river mouths have been and still are being reworked by strudel scour, resulting in highly irregular bedding.

The mixing of Holocene marine with older sediments by vertical strudel flow causes great variability in sediment types over small areas. These new observations add further complicating factors to be considered in the interpretation of shallow water deposits of cold climates.

(F) A listing of published articles, and/or papers, pre-prints, in-house reports, abstracts of talks, that were released during the reporting period:

Barnes, P. W., and Reimnitz, Erk, 1972, River overflow onto the sea ice off the northern coast of Alaska, Spring 1972 [abs.]: Am. Geophys. Union Trans., v. 53, no. 11, p. 1020.

Barnes, P. W., and Reimnitz, Erk, 1973, New insights into the coastal marine environment of the Beaufort Sea from field data and ERTS-1 imagery [abs.]: Symposium on Significant Results Obtained from ERTS-1, sponsored by NASA Goddard Space Flight Center, Paper M7, p. 146.

Barnes, P. W., Reimnitz, Erk, Gustafson, C. W., and Larsen, B. R., in press, U.S.G.S. marine geologic studies in the Beaufort Sea off Northern Alaska, 1970 through 1972: U.S. Geol. Survey open-file report.

Barnes, P. W., and Reimnitz, Erk, in press, New insights into the influence of ice on the coastal marine environment of the Beaufort Sea, Alaska: To be published by NASA as Symposium Proceedings, 8 p. including figures.

Carlson, P. R., and Reimnitz, Erk, 1973, Study of river effluents and coastal water circulation off the west coast of North America using ERTS-1 Data [abs.]: Geol. Soc. America, Cordilleran Section, 69th Annual Meeting, p. 20.

Reimnitz, Erk, and Barnes, P. W., 1972, Sea ice as a geological agent affecting the margin of the Arctic [abs.]: Am. Geophys. Union Trans., v. 53, no. 11, p. 1008.

Reimnitz, Erk, Rodeick, C. A., and Wolf, S. C., manuscript released for review, Strudel scour in the deltaic environment of the Beaufort Sea shelf, Alaska: To be sent to Geol. Soc. America for publication in the Bulletin.

- (G) Recommendation concerning practical changes in operations, additional investigative effort, correlation of effort and/or results as related to a maximum utilization of the ERTS system:

Consecutive day coverage from overlapping passes at high latitude has proven to be most useful in our studies, since specific ice features can be studied in their development or movement over a 24-hour period. After checking coverage obtained in our test area before the winter, we concluded that we have not received all possible coverage from the area, even when the weather appears to have been favorable. We recommend strongly that all possible imagery be obtained in our study area during the last half of this program, especially after the middle of May, when the ice in the rivers will begin to break up and fresh water inundation of sea ice begins.

- (H) Changes in standing orders this period: none
- (I) ERTS Descriptor forms: none
- (J) Change of Data Request forms this period: none
- (K) N/A